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Cost of Developing Value-added Foods from Arkansas Surplus Produce: Acid and Acidified Products

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Overview

Developing value-added foods from surplus produce for commercial markets in a certified processing facility can be a starting point for growers to supplement income (McWhirt et al., 2020). Acidified foods, foods that are acidic or made acidic, are a great option for value-added foods because costs are lower than for the production of low-acid products, due to lower initial capital investment and regulatory requirements. The first year of production of value-added products is more expensive due to startup costs (i.e., recipe development, testing, labeling, marketing), but future production costs and larger production batches can improve profits.

Introduction

Value-added foods are made from agricultural products to increase market value, extend shelf life, or create new sales opportunities. Examples of value-added foods include jams, jellies, sauces, pickled vegetables, and other shelf-stable products made from surplus or imperfect produce. These value-added foods can help producers reduce waste and sell products beyond the fresh-market season.

The University of Arkansas Division of Agriculture (UADA) explored value-added food production in a project, Expanding Farmers' Opportunity in Northwest Arkansas, funded by the USDA Agricultural Marketing Service. The project transformed surplus and imperfect produce from Arkansas growers into shelf-stable food. Recipes were developed with Brightwater: A Center for the Study of Food, the products were produced at the UADA Arkansas Food Innovation Center, and marketing assistance was provided by the University of Arkansas Sam M. Walton College of Business. This fact sheet reviews the costs of producing acid and acidified value-added foods from fresh produce for commercial markets using a certified food processing facility.

Regulations for Acid and Acidified Food Products

In Arkansas, commercial food processing may take place in permitted facilities such as commercial kitchens, food hubs, or co-ops. These facilities must

meet state and federal food safety regulations. However, some acid and acidified foods can be made in a home kitchen and sold directly to informed consumers under the Arkansas Food Freedom Act (Arkansas Food Freedom Act / Act 1040: Arkansas General Assembly, 2021). Producers can also reference the Arkansas Homemade Food Production Guidelines for current requirements (Arkansas Homemade Food Production Guidelines: Arkansas Department of Health, 2024).

For food products, the acidity, measured on a scale of 0 to 14 with 0 as very acidic, 7 as neutral, and 14 as basic, is important to food safety. Foods that are considered acid foods are naturally acidic foods with a pH of 4.6 or below, such as many fruits. Acidified foods are low-acid foods that have acid (vinegar or lemon juice) added to lower the pH to 4.6 or below. Examples of acidified foods include pickled vegetables, salsas, and sauces.

Description of Products Developed

Five acidified products were developed for this project using surplus produce from Arkansas growers. The surplus produce was used to create 450 jars of each product. Surplus produce was collected, preprocessed (trimmed, peeled, or chopped), and frozen before production. The estimated surplus produce values were not included in the production costs. Produce quantities were estimated by accounting for a 20% loss during preprocessing but may vary with season, quality, and local market conditions. Each product was produced in a batch of 450 jars. Equipment was also not included in the production costs because these costs were included in rental costs of the commercial manufacturing facility.

Figure 1 shows a client inspecting jars of product during production. *Note: The production costs for 450, 1-pint (16 oz) jars for all products, except Apple Pie Apples which were for 1-quart (28 oz) jars, were estimated based on values from the project.*

Figure 1. A grower/client inspects a product during processing at the Arkansas Food Innovation Center.



Acid products

- *Apple Pie Apples* – About 375 pounds of preprocessed apple slices (peeled, cored, and sliced) (estimated surplus value of $445.31 at@ $0.95 per pound) were used to produce 450 1-quart (28 oz) jars as an acid product. The product included apples, lemon, cider, sugar, and cinnamon.
- *Bloody Mary Mix* – About 860 pounds of preprocessed tomatoes (trimmed and sliced) (estimated surplus value of $913.75 at $0.85 per pound) were used to produce 450 1-pint (16 oz) jars as an acid product. The mix included tomatoes, carrots, Worcestershire sauce, lemon juice, horseradish, and spices.

Acidified Products

- *Carrot BBQ Sauce* – About 260 pounds of preprocessed carrots (trimmed and sliced) (estimated surplus value of $227.50 at $0.70 per pound) were used to produce 450 1-pint (16 oz) jars as an acidified product. The sauce combined carrots, apple cider vinegar, molasses, soy sauce, and spices to create a sweet-and-tangy barbecue-style sauce. Figure 1 and 3 shows filling and inspection of the sauce.
- *Ratatouille* – About 280 pounds of pre-processed (trimmed and sliced) tomatoes and 125 pounds of zucchini preprocessed (estimated surplus value of $413.13 at $0.74 per pound) were used to produce 450 1-pint (16 oz) jars as an acidified product. The product included tomatoes, roasted red peppers, zucchini, squash, eggplant, herbs, and garlic.

- *Sweet Italian Pepper Sauce* – About 260 pounds of pre-processed peppers (trimmed) (estimated surplus value of $406.25 at $1.25 per pound) were used to produce 450 1-pint (16 oz) jars as an acidified product. The sauce included Italian fry peppers, jalapeño, garlic, apple cider vinegar, and spices.

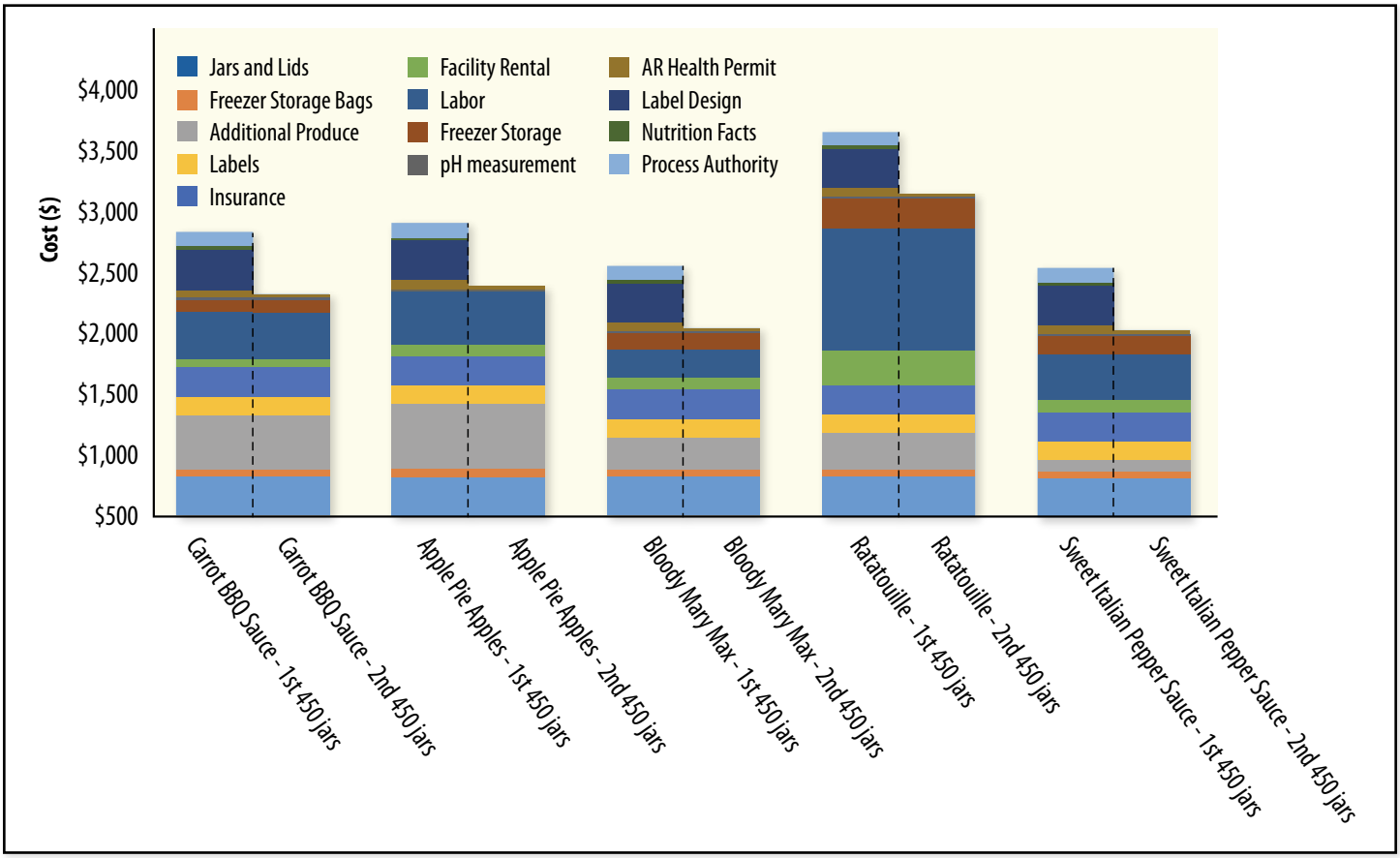
Description of Costs for Acidified Food Products

Table 1 and Figure 2 show the costs of production of acid and acidified food products made from surplus produce from Arkansas growers. Costs were calculated based on production of 450 units in Year 1 and 450 units in Year 2. The Year 1 costs included start-up costs, such as label design, nutrition facts panel development, and process authority review. Year 2 costs did not include start-up costs. Cost categories included costs of goods sold, other expenses, and start-up costs.

- *Costs of Goods Sold*. The costs of each batch included the costs of jars and lids ($391.50), freezer storage bags ($67.85), and jar labels ($180.00). Jars and lids were $0.87 per unit, freezer storage bags were $0.15 per bag, and labels $0.40 per unit. The costs of additional produce and ingredients used for the production of the products varied from $121.03 (Sweet Italian Peppers) to $666.00 (Apple Pie Apples).

- *Other Expenses*. Other expenses included insurance, facility rental, labor, freezer storage rental, pH measurements, and the annual Arkansas Department of Health permit. Other expenses that remained the same regardless of product included insurance ($300.00), pH measurements ($20.00), and the annual Arkansas Department of Health permit ($85.00). The facility rental, labor, and freezer storage rental varied by product. The production facility rental was $15.00 per hour, labor was $15.00 per hour per person, and freezer storage was $1.00 per cubic foot per month.

Figure 2. Year 1 and Year 2 costs[1] from producing 450 jars of value-added acid and acidified food products made from surplus produce from Arkansas growers.



[1]*The costs of the produce are not included in the analysis since these were surplus and would not have been utilized by the grower. The production costs for 450 1-pint (16 oz) jars for all products, with the exception of for Apple Pie Apples, which were for 1-quart (28 oz) jars, were estimated based on actual values from the project.*

- *Start-up Costs*. Start-up costs were $580.00 per product and included label design ($400), a nutrition facts panel ($30), and process authority review ($150). These costs represented fixed investments or packaging expenses in Year 1 that did not vary by product.

- *Overall Costs*. The overall cost per jar for these products ranged from $5.57 to $8.59. The overall cost for the acid products was $6.53 and $5.59 per jar for Apple Pie Apples and Bloody Mary Mix, respectively with an average cost per jar of $6.06. The overall cost for the acidified products was $6.34,

	ACID PRODUCTS		ACIDIFIED PRODUCTS		
	Apple Pie Apples	Bloody Mary Mix	Carrot BBQ Sauce	Ratatouille	Sweet Italian Pepper Sauce
Cost of Goods Sold [1,2]					
Jars and Lids	$391.50	$391.50	$391.50	$391.50	$391.50
Freezer Storage Bags	$67.85	$ 67.85	$67.85	$67.85	$ 67.85
Additional Produce/Ingredients	$666.00	$328.50	$553.50	$366.41	$121.03
Labels	$180.00	$180.00	$180.00	$180.00	$180.00
Total Cost of Goods Sold	$1,305.35	$967.85	$1,192.85	$1,005.76	$760.38
Other Expenses					
Insurance	$300.00	$300.00	$300.00	$300.00	$300.00
Facility Rental	$112.50	$114.08	$81.00	$353.08	$123.85
Labor	$535.50	$285.21	$472.50	$1,215.00	$454.13
Freezer Storage Rental	$0	$162.25	$121.50	$304.62	$181.65
pH measurement	$20.00	$20.00	$20.00	$20.00	$20.00
Arkansas Department of Health Permit	$85.00	$85.00	$85.00	$85.00	$85.00
Total Other Expenses	$1,053.00	$966.55	$1,080.00	$2,277.69	$1,164.63
Start-up Cost					
Label Design	$400.00	$400.00	$400.00	$400.00	$400.00
Nutrition Facts Panel	$30.00	$30.00	$30.00	$30.00	$30.00
Process Authority Certification	$150.00	$150.00	$150.00	$150.00	$150.00
Total Start-up Cost	$580.00	$580.00	$580.00	$580.00	$580.00
Overall Cost					
Cost per jar	$6.53	$5.59	$6.34	$8.59	$5.57
Retail price per jar (40% mark-up)	$9.14	$7.82	$8.88	$12.02	$7.79
Sales and Income					
Sales revenue	$4,113.68	$3,520.15	$3,993.98	$5,408.83	$3,507.02
Net Income (Sales Revenue-total costs)	$1,175.34	$1,005.76	$1,141.14	$1,545.38	$1,002.00

Table 1. Year 1 cost of producing 450 jars of value-added acid and acidified food products made from surplus produce from Arkansas growers.

[1]*The costs of the produce are not included in the analysis since these were surplus and would have not have been utilized by the grower.*
[2]*The production costs for 450, 1-pint (16 oz) jars for all products, with the except for ion of Apple Pie Apples, which were for 1-quart (28 oz) jars, were estimated based on actual values from the project.*

Figure 3. Carrot BBQ Sauce is filled into jars during production.



$8.59, and $5.57 per jar for Carrot BBQ Sauce, Ratatouille, and Sweet Italian Pepper Sauce, respectively, with an average cost per jar of $6.83. The acid products (Apple Pie Apples and Bloody Mary Mix) were the most economical, making them strong candidates for scaled-up production and sales. Overall, Ratatouille had the highest production cost per jar due to higher labor costs and preparation complexity (hand cutting vegetables), suggesting that larger batch sizes or process efficiencies should be considered before scaling up production. Figure 2 shows the Year 1 and Year 2 costs from producing 450 jars of value-added acid and acidified food products made from surplus produce from Arkansas growers. Small changes in ingredients, labor, storage, and processing time strongly affect cost per jar and retail price. Producers should calculate costs before production, consider different batch sizes, and assess whether a product can be priced competitively in their intended market.

- *Sales and Income*. The Manufacturer's Suggested Retail Price (MSRP) was set with a 40% mark-up on cost per jar. The retail price per jar for these products ranged from $7.79 to $12.02. The retail price for the acid products was $9.14 and $7.82 per jar for Apple Pie Apples and Bloody Mary Mix, respectively. The retail price for the acidified products was $8.88, $12.02, and $7.79 per jar for Carrot BBQ Sauce, Ratatouille, and Sweet Italian Pepper Sauce, respectively. The projected net income for these products ranged from $1,002 to $1,545. The net income for the acid products was $1,175 and $1,006 for Apple Pie Apples and $1,006 for Bloody Mary Mix, respectively. The net income for the acidified products was $1,141, $1,545, and $1,002 for Carrot BBQ Sauce, Ratatouille, and Sweet Italian Pepper Sauce, respectively.

Product Case Study: Carrot BBQ Sauce

To illustrate how cost categories affect product pricing and profitability, the following case study focused on Carrot BBQ Sauce as an example of an acidified value-added food product produced from surplus Arkansas produce in a commercial manufacturing facility.

The production of Carrot BBQ Sauce demonstrated that acidified foods could be an entry-level product for growers. For Year 1 production, Cost of Goods Sold totaled $1,192.85, and other expenses totaled $1,080.00. Start-up costs added $580.00, and projected net income was $1,141.14 with a retail price of $8.88/jar. For Year 2 production, some start-up costs were eliminated. The production cost dropped to $4.94 per jar, and projected net income increased to $1,771.14, with the same retail price as Year 1. In a scenario where 2,000 jars are produced in Year 2 or Year 3, the production cost per jar drops to $4.33 per jar, with total production cost at $8,657. Maintaining the retail price at $8.88, this would generate a projected net income of $9,093.50 (Figure 4). This simulation shows that once those start-up costs are paid, later batches can generate higher returns. Producing more than one batch, or increasing batch size, can significantly improve profitability.

Conclusions

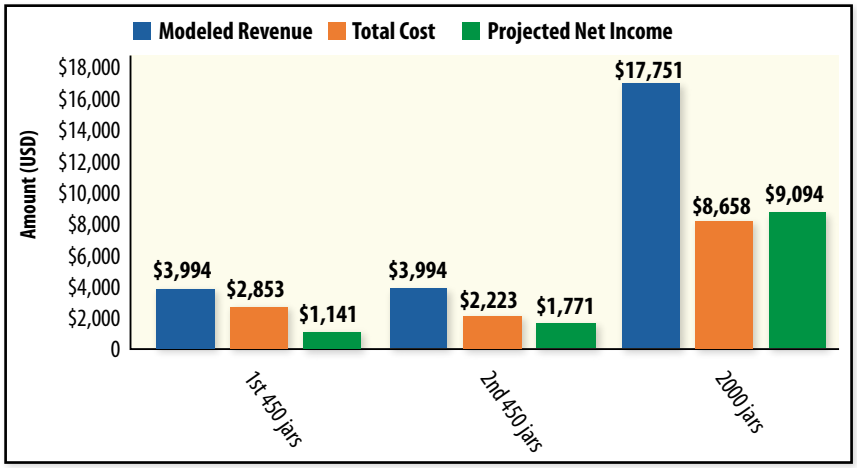
Acid and acidified foods can provide a value-added opportunity for small-scale Arkansas produce growers by using surplus produce and extending sales beyond the fresh-market season.

Before production, growers should confirm regulatory requirements, costs, scale of produce needed, labor and facilities for production. Producing additional or larger batches may reduce the effect of one-time start-up costs, but profitability will depend on actual production efficiency, pricing, and sales.

Acknowledgment

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Figure 4. Modeled costs[1], revenue[2], and projected net income for Carrot BBQ Sauce produced from surplus Arkansas carrots under three scenarios: Year 1 (450 jars), Year 2 (450 jars), and Year 3 (2,000 jars).



[1]Costs include start-up costs for the first 450 jars in Year 1 but exclude them from the second 450-jar batch in Year 2 and the 2,000-jar batch in Year 3.
[2]Modeled revenue assumes a constant retail price of $8.88 per jar across all three years.

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